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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

|                   |     |
|-------------------|-----|
| REC'D 21 JUL 2005 |     |
| WIPO              | PCT |

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|--|---|---|
| Applicant's or agent's file reference<br>2003UR028   | FOR FURTHER ACTION See Form PCT/IPPA/416                                |   |
| International application No.<br>PCT/US04/18954  | International filing date (day/month/year)<br>15 June 2004 (15.06.2004) | Priority date (day/month/year)<br>02 July 2003 (02.07.2003) |
| International Patent Classification (IPC) or national classification and IPC<br>IPC(7): C09K 3/00, E21B 43/28, C07C 9/00 and US Cl.: 507/90; 585/15, 950 |   |   |
| Applicant<br>EXXONMOBIL UPSTREAM RESEARCH COMPANY  |   |   |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

- a. ☒ (sent to the applicant and to the International Bureau) a total of 1 sheets, as follows:
  - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
  - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

|  |  |
|--|--|
| Date of submission of the demand<br>29 April 2005 (29.04.2005)   | Date of completion of this report<br>13 June 2005 (13.06.2005)   |
| Name and mailing address of the IPEA/ US<br>Mail Stop PCT, Attn: IPEA/US<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, Virginia 22313-1450<br>Facsimile No. (703) 305-3230 | Authorized officer<br>Philip C. Tucker<br>Jean Proctor<br>Paralegal Specialist<br>Telephone No. 571-272-1700 |

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/18954

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))  
☐ publication of the international application (under Rule 12.4)  
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-25 \_\_\_\_\_ as originally filed/furnished

pages\* 26 \_\_\_\_\_ received by this Authority on 29 April 2005 (29.04.2005)

pages\* NONE \_\_\_\_\_ received by this Authority on \_\_\_\_\_

☒ the claims:

pages 27-30 \_\_\_\_\_ as originally filed/furnished

pages\* NONE \_\_\_\_\_ as amended (together with any statement) under Article 19

pages\* NONE \_\_\_\_\_ received by this Authority on \_\_\_\_\_

pages\* NONE \_\_\_\_\_ received by this Authority on \_\_\_\_\_

☒ the drawings:

pages 1 \_\_\_\_\_ as originally filed/furnished

pages\* NONE \_\_\_\_\_ received by this Authority on \_\_\_\_\_

pages\* NONE \_\_\_\_\_ received by this Authority on \_\_\_\_\_

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/figs \_\_\_\_\_

☐ the sequence listing (*specify*): \_\_\_\_\_

☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/figs \_\_\_\_\_

☐ the sequence listing (*specify*): \_\_\_\_\_

☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

*\* If item 4 applies, some or all of those sheets may be marked "superseded."*

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/US04/18954**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

|                               |                              |     |
|-------------------------------|------------------------------|-----|
| Novelty (N)                   | Claims <u>1-25</u>           | YES |
|                               | Claims <u>NONE</u>           | NO  |
| Inventive Step (IS)           | Claims <u>15-17</u>          | YES |
|                               | Claims <u>1-14 and 18-25</u> | NO  |
| Industrial Applicability (IA) | Claims <u>1-25</u>           | YES |
|                               | Claims <u>NONE</u>           | NO  |

**2. Citations and Explanations (Rule 70.7)**

Claims 1-14 and 18-23 lack an inventive step under PCT Article 33(3) as being obvious over Bakeev (US 6,117,929). Bakeev teaches a method of retarding the formation of gas hydrates using vinyl caprolactam polymers. Example 5 teaches the use of a polymer having a molecular weight of 31,250 to inhibit hydrate formation. The claims teach the use of polymers of molecular weight 500 to 2500 to inhibit formation of gas hydrates. It would be obvious to one of ordinary skill in the art to utilize a combination of polymers of different molecular weights to inhibit gas hydrates, since that is the purpose that they are individually taught useful.

Claims 1-14 and 18-25 lack an inventive step under PCT Article 33(3) as being obvious over Colle (US 6,222,083). Colle teaches a method of inhibiting hydrate formation using an N-acyldehydroalanine polymer. The polymer may be any that has a molecular weight of 1,000 to 1,000,000. It would be obvious to one of ordinary skill in the art to utilize a combination of polymers of weights between 1,000 and 1,000,000 in order to inhibit gas hydrates, since that is the purpose that they are individually taught useful.

Claims 15-17 the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the bimodal combination with the polymer taught in the claims.

Claims 1-25 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Table 2. Polymer Molecular Weight Distributions and Subcooling Temperatures

N-Vinylcaprolactam (VCap) Polymers

|  | Molecular Weight Distribution (Mass %) |        |        |        |       |        |        |         |          |          |            |         | Subcooling                        |        |
|--|--|--------|--------|--------|-------|--------|--------|---------|----------|----------|------------|---------|-----------------------------------|--------|
| Example                                | <0.5K                                  | 0.5-1K | 1-2.5K | 2.5-5K | 5-10K | 10-20K | 20-50K | 50-100K | 100-250K | 250-500K | 500-1,000K | >1,000K | @20 Hour Hold Time<br>(°F and °C) |        |
| Example 4<br>90% TR-544 +<br>10% GH267 | 29.17                                  | 24.88  | 24.84  | 7.92   | 4.14  | 2.87   | 2.98   | 1.6     | 1.1      | 0.3      | 0.1        | 0       | 34°F                              | 18.9°C |
| Example 5B<br>R5-772                   | 89.8                                   | 7.96   | 2.2    | 0.04   | 0     | 0      | 0      | 0       | 0        | 0        | 0          | 0       | 28°F*                             | 15.6°C |
| Example 5A<br>GH 267                   | 0.1                                    | 1.3    | 3.6    | 5.4    | 10.8  | 18.8   | 28     | 16      | 11.7     | 3.1      | 1.0        | 0.2     | 18°F                              | 10°C   |
| Example 5C<br>TR-544                   | 32.4                                   | 27.5   | 27.2   | 8.2    | 3.4   | 1.1    | 0.2    | 0       | 0        | 0        | 0          | 0       | 30°F                              | 16.7°C |
| Example 5D<br>90% R5-722<br>+10% GH267 | 80.83                                  | 7.3    | 2.3    | 0.58   | 1.08  | 1.88   | 2.8    | 1.6     | 1.1      | 0.3      | 0.1        | 0       | 27°F                              | 15°C   |

\*Concentration 0.45 wt% and hold time 18 hours.

ATTENDED SHEET

IPEA/US